

### NOVEL POLARIZATION-CONTROLLABLE $TE_{21}$ MODE CONVERTER\*

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We report the concept and development of a Ka-band two-port mode and polarization converter that efficiently converts a  $TE_{10}$  rectangular waveguide mode into either a linearly or a circularly polarized  $TE_{21}$  cylindrical waveguide mode. The converter is formed of a power-dividing section, a mode-converting section, and a polarization-transitioning section. The conversion process in each section is analyzed and the design considerations are discussed. A proto-type has been designed, constructed, and tested. The measurement results agree well with the numerical calculations for both linear and circular polarizations. The measured optimum back-to-back transmissions are 94% with a 3-dB bandwidth of 5.7 GHz for linear polarization and 97% with a 3-dB bandwidth of 4.5 GHz for circular polarization. For further diagnostics, the field pattern of either polarization is directly displayed on a temperature sensitive liquid crystal display sheet, where the electric field strength can be discerned from the color spectrum. In addition to high conversion efficiency and broad bandwidth, this converter features easy construction, high mode purity, and polarization controllability.

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### HIGH PERFORMANCE CIRCULAR $TE_{01}$ MODE CONVERTER\*

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The development and experimental test of a Ka-band  $TE_{01}$  mode converter are presented. A wave in  $TE_{10}$  rectangular waveguide mode is efficiently converted into the  $TE_{01}$  circular waveguide mode. This converter is composed of a power-dividing section and a mode-converting section. The field pattern and the working principle of each section are analyzed and discussed. A prototype has been built and tested. Back-to-back transmission measurements show excellent agreement with computer simulations. The measured optimum transmissions are 97% with 1-dB bandwidth of 5.8 GHz and 3-dB bandwidth of 7 GHz. High mode purity is predicted in theory and demonstrated in experiment. The field pattern of the circular  $TE_{01}$  mode is directly displayed on a temperature sensitive liquid crystal sheet, where the electric field strength can be discerned from the color spectrum. In addition to three just mentioned advantages, high converting efficiency, high mode purity, and broad bandwidth, this converter also features easy constructions and compact size.

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